Small Business Innovation Research/Small Business Tech Transfer

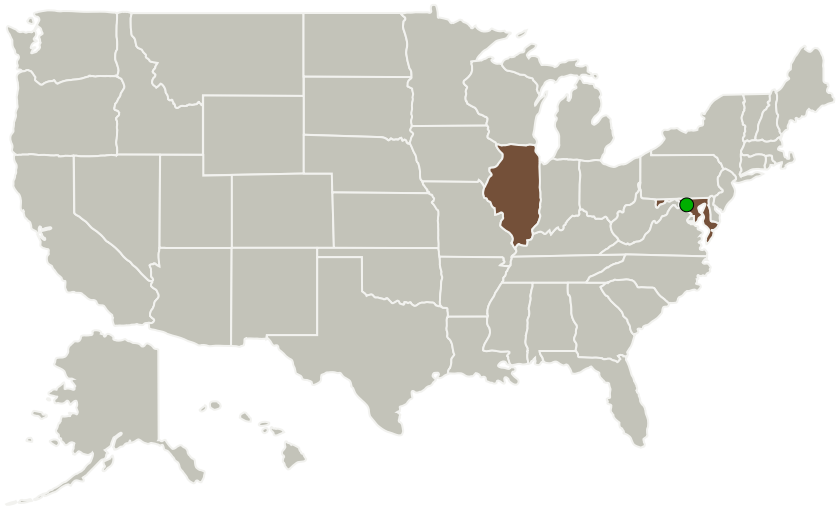
Type-II Superlattice Based Low Dark Current Short-Wavelength Infrared Photodetectors With Optical Response From 0.4 to 2.5um, Phase I

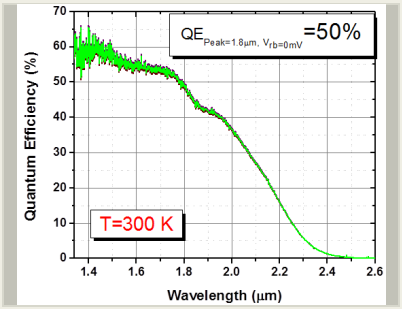
Completed Technology Project (2017 - 2017)

Project Introduction

In recent years, Type-II superlattices have experienced significant development. However, the full potential of Type-II superlattice has not been fully explored and alternate superlattice architectures hold great promise. Despite demonstration of SWIR photodetectors based on this material system, there has been no report about Type-II superlattice-based photodetectors that have been sensitive to visible light. We propose to develop Type-II superlattice-based photodetectors and focal plane arrays for NASA's imaging and spectroscopy applications in the spectral band from visible to extended short-wavelength infrared (0.4 - 2.5 um) with a very low dark current density. In mid- and long-wavelength infrared spectral bands, Type-II superlattice-based photodetectors already offers performance comparable to the state-of-the-art mercury cadmium telluride but at a fraction of the cost due to the leveraging of commercial growth and process equipment. Our goal is to extend that benefit into the short-wavelength infrared. Using the best material currently available and a novel bandgap-engineering design and process, we will fabricate photodetectors and, ultimately, focal plane arrays. In Phase I, we are going to demonstrate photodetector designs based on Type-II superlattices, which can cover spectral range between 0.4 to 2.5 um with a very low dark current density (<10^-11 A/cm2) at temperatures below 100 K.. In Phase II, we are going to continue reduction of the dark current density to <10^-13 A/cm^2 -level at temperatures below 100K. Then, we will use the optimized device design to develop and deliver 1Kx1K imagers to NASA for planetary sciences.

Primary U.S. Work Locations and Key Partners





Type-II superlattice based low dark current short-wavelength infrared photodetectors with optical response from 0.4 to 2.5um, Phase I Briefing Chart Image

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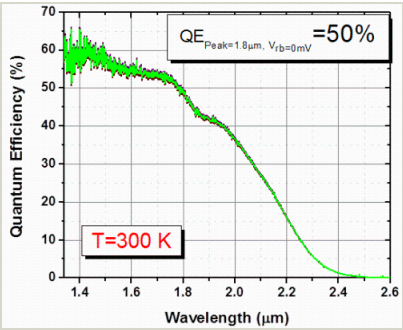
Organizations Performing Work	Role	Type	Location
Nour, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Wilmette, Illinois
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Illinois	Maryland

Images



Briefing Chart Image
Type-II superlattice based low dark current short-wavelength infrared photodetectors with optical response from 0.4 to 2.5um, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/136625)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Nour, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

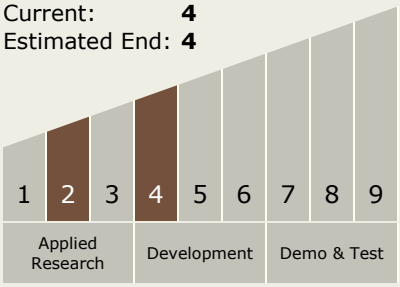
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Abbas Haddadi

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2017 - 2017)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes